

REMARKS

In response to the Office Action, Applicant respectfully requests the Examiner to reconsider the above-captioned application in view of the foregoing amendments and the following comments. Claim 35 was inadvertently labeled as “withdrawn” in Applicant’s previous amendment. This claim is now labeled as “Currently amended” to reflect a minor grammatical correction. As this claim is included within the invention, further examination of this claim is respectfully requested.

Discussion of Claim Rejections Under 35 U.S.C. § 103

Claims 1, 2, 15, and 29 have been rejected under 35 U.S.C. § 103 as being unpatentable over JP 2002-334618. As stated above, Claim 35 is also included in the elected invention. Therefore, Applicant addresses patentability of Claim 35 as well in here, and respectfully submits that the Claims 1, 2, 15, 29, and 35 are allowable over the prior art.

Referring to “verified translation of Claims and paragraph [0013] to paragraph [0042] of JP 2002-334618 submitted on April 14, 2009, in particular paragraph [0016] to [0018], the reference discloses the following fine metal particle dispersion and fine metal particle being dispersed in the dispersion. The fine metal particle being dispersed in the dispersion is of course being dispersed in an organic solvent. Thus, the fine metal particles being dispersed in the dispersion are by no means fine metal particles in the form of a dry powder, as presently claimed.

The claimed fine metal particles in the form of a dry powder are by no means in contact with any organic solvent, whereas the fine metal particles of JP 2002-334618 are always in contact with organic solvent. In view of this fact, JP 2002-334618 by no means discloses any fine metal particles in the form of a dry powder. Accordingly, JP 2002-334618 fails to teach or suggest any process for preparing any fine metal particles in the form of a dry powder from the fine metal particle dispersion disclosed in Paragraph 0016 to 0018 of the reference.

Indeed, JP 2002-334618 teaches the following fine metal particle dispersion in paragraphs [0016] – [0018]:

[0016]

In addition, the present invention provides an invention of a fine metal particle dispersion that is used for the process for formation of the conductive metal film as defined by the aforementioned features, which process is used substitutionally for plating. Namely, the fine metal particle dispersion according to the present invention is:

a fine metal particle dispersion being usable to form a conductive film, which film is substitutionally used for a metal plating film, characterized in that:

said fine metal particle dispersion comprises a fine metal particle having an average particle size selected in the range of 1 to 100 nm, which is dispersed in an organic solvent that is used as a dispersion medium thereof,

wherein

the surface of the fine metal particle being dispersed therein is coated with one or more compounds having a group containing a nitrogen atom, an oxygen atom or a sulfur atom, which group is used as a group capable of forming a coordinative bond with a metal element contained in the fine metal particles, and

the compounds having the group containing the nitrogen atom, oxygen atom or sulfur atom, which group is used as a group capable of forming a coordinative bond with the metal element, is capable of being detached from the surface of the fine metal particle by heat-treatment at a temperature being no higher than 250°C.

[0017]

In the case of the fine metal particle dispersion according to the present invention,

it is preferred that the fine metal particle dispersion is characterized by:

a compound having reactivity to the group containing a nitrogen, oxygen or sulfur atom at the temperature of carrying out the heat-treatment for the compound having the group containing the nitrogen, oxygen or sulfur atom, which group is used as a group capable of forming a coordinative bond with the metal element to coat on the surface of the fine metal particle, is dissolved in the fine metal particle dispersion. In such a case, said compound having reactivity to the group containing a nitrogen, oxygen or sulfur atom, which is contained in the fine metal particle dispersion, is preferably an organic acid anhydride or a derivative thereof or an organic acid.

[0018]

On the other hand, the fine metal particle dispersion according to the present invention, may include

such an embodiment of the fine metal particle dispersion,

wherein, in accordance with the material of the plating film to be substituted therewith, said fine metal particle contained in the fine metal particle dispersion is a fine particle made of a metal selected from the group consisting of gold, silver, copper, platinum, palladium, tungsten, nickel, tantalum, bismuth, lead, indium, tin, zinc, titanium and aluminum, or a fine particle made of an metal alloy of two or more metals selected from the aforementioned group of metals.

Even if the fine metal particle dispersion disclosed in JP 2002-334618 were dried, there is no good reason to conclude that the claimed fine metal particles in the form of a dry powder from the fine metal particle dispersion would be prima facie obvious.

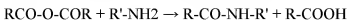
JP 2002-334618 teaches a method of using fine metal particle dispersion for formation of plating-substitute conductive metal film, and fine metal particle dispersion that is suitably used to

form plating-substitute conductive metal film. In other words, JP 2002-334618 teaches good guidelines for selecting the suitable compound for coating on the surface of the fine metal particles and the suitable organic solvent to be used as a dispersion medium, and the content of the organic solvent, which are fit to the use of fine metal particle dispersion. Accordingly, JP 2002-334618 fails to suggest that the suitable selection of the compound for coating on the surface of the fine metal particles in a dispersion and the content of the compound that is contained in the fine metal particle dispersion would be suitable selections of the compound for coating on the surface of the fine metal particles and the content of the compound that is contained in the fine metal particle in the form of a dry powder.

Moreover, JP 2002-334618 fails to teach any fine metal dispersion, in which carboxylic acid (R-COOH) or carboxylate composed of a metal cation species and a carboxylic acid anion species (R-COO⁻M⁺) is used as a compound for coating on the surface of the fine metal particles, and the fine metal particles coated with the carboxylic acid (R-COOH) or carboxylate (R-COO⁻M⁺) are dispersed in an organic solvent.

JP 2002-334618 teaches such use of carboxylic acid (R-COOH) or carboxylic acid anhydrate (RCO-O-COR) solely as agent for removing the coating molecules such as alkyl amine from the surface of the fine metal particles, when heated at a temperature of no higher than 250°C. JP 2002-334618 also teaches such use of carboxylic acid anhydrate (RCO-O-COR) as agent for removing the thin film of metal oxide (MO) from the surface of the fine metal particles, when heated at a temperature of no higher than 250°C.

Thus, JP 2002-334618 teaches the following reactions which are initiated by heating at a temperature of no higher than 250°C.



Thus, JP 2002-334618 fails to suggest that such metal salts of carboxylic acid ((RCOO)₂M) that are formed by the reaction of carboxylic acid anhydrate (RCO-O-COR) with metal oxide (MO) would be used as a compound for coating on the surface of the fine metal particles, and the fine metal particles coated with the carboxylic acid (R-COOH) or carboxylate (R-COO⁻M⁺) would be successfully dispersed in an organic solvent.

Accordingly, JP 2002-334618 fails to suggest any fine metal particles in the form of a dry powder, in which carboxylic acid (R-COOH) or carboxylate composed of a metal cation species and a carboxylic acid anion species ($\text{R-COO}^-\text{M}^+$) is used as a compound for coating on the surface of the fine metal particles.

In conclusion, the claimed fine metal particles in the form of a dry powder, in which carboxylic acid (R-COOH) or carboxylate composed of a metal cation species and a carboxylic acid anion species ($\text{R-COO}^-\text{M}^+$) is used as a compound for coating on the surface of the fine metal particles are by no mean obvious over JP 2002-334618..

JP 2002-334618 also fails to provide any reason as to the specific choice of the thickness of the covering layer formed with the adjusted covering amount such that "a thickness of the covering layer formed with the adjusted covering amount is at least 0.5 nm or thicker, and selected in the range of 2/10 to 8/10 of the average particle size of the fine metal particles."

In such a case if the thickness of the covering layer for the fine metal particle in the form of a dry powder is optimized by experimental trial, the fine metal particles in the form of a dry powder having variety of the thickness of the covering layer should be compared with each other. Thus, the fine metal particles in the form of a dry powder having variety of the thickness of the covering layer should be prepared for such comparison.

However, JP 2002-334618 fails to teach or suggest a process for preparation of the fine metal particles in the form of a dry powder having variety of the thickness of the covering layer. Therefore, a person skilled in the art can never routinely carry out such comparison among the fine metal particles in the form of a dry powder having variety of the thickness of the covering layer in order to experimentally discover an optimum value of result-effective variable, based on the disclosure of JP 2002-334618.

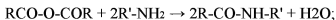
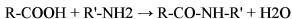
Furthermore, even if it would have been obvious to one skilled in the art to have optimized the thickness of the covering layer on the fine metal particles, which are dispersed in the fine metal particle dispersion of JP 2002-334618, in order to achieve the optimized dispersion property of the fine metal particles dispersed in an organic solvent, JP 2002-334618 fails to suggest any reason for the optimization of the thickness of the covering layer on the claimed fine metal particles, which are kept in the form of a dry powder.

JP 2002-334618 teaches a process for preparing the fine metal particle dispersion, and a guideline for the choice of organic solvent to be used as a dispersion medium contained in the fine metal particle dispersion. However, JP 2002-334618 fails to teach any process for preparation of the fine metal particles in the form of a dry powder, and any guideline for the choice of organic solvent to be suitably used in the process for preparation of the fine metal particles in the form of a dry powder. Accordingly, JP 2002-334618 fails to suggest any fine metal particles in the form of a dry powder, in place of the fine metal particle dispersion. Thus, there is disclosed in JP 2002-334618 no reason to lead a person skilled in the art to the preparation of the fine metal particles in the form of a dry powder,

Further, referring to claim 1 JP 2002-334618, JP 2002-334618 clearly suggests a process for formation of plating-substitute conductive metal film using such fine metal particle dispersion, in which no compound having reactivity to the group containing a nitrogen, oxygen or sulfur atom at the temperature of carrying out the heat-treatment is added, and the compound for coating on the surface of the fine metal particles are removed from the surface of the fine metal particles by thermal detachment when heated at a temperature of no higher than 250°C, so that the conductive metal film is formed from the fine metal particles having no coating of the compound having a group containing a nitrogen, oxygen or sulfur atom. Therefore, JP 2002-334618 suggests only the production of a dispersion of particles for production of a conductive metal film, and fails to suggest that, in the case if no compound having reactivity to the group containing a nitrogen, oxygen or sulfur atom at the temperature of carrying out the heat-treatment is added in the fine metal particle dispersion, evaporation of the organic solvent in the dispersion by heat treatment at a temperature lower than 250°C will be successfully carried out to obtain the claimed dry fine metal particles covered with the coating of the compound.

JP 2002-334618 teaches such preferable process for formation of plating-substitute conductive metal film using such fine metal particle dispersion, in which a compound having reactivity to the group containing a nitrogen, oxygen or sulfur atom at the temperature of carrying out the heat-treatment, such as carboxylic acid (R-COOH) or carboxylic acid anhydride (RCO-O-COR), is added in the dispersion, the compound for coating on the surface of the fine metal particles (e.g. alkyl amine R-NH₂) is removed from the surface of the fine metal particles by thermal detachment when heated at a temperature of no higher than 250°C, and then the detached

compound (e.g. alkyl amine R-NH₂) can be quickly reacted with the compound having reactivity, such as carboxylic acid (R-COOH) or carboxylic acid anhydride (RCO-O-COR): i.e.



so that the concentration of the detached compound (e.g. alkyl amine R-NH₂) being solved in the organic solvent is reduced by the aforementioned reactions, and thereby, the substantial acceleration of detachment of the compound (e.g. alkyl amine R-NH₂) is achieved by the help of the compound having reactivity, such as carboxylic acid (R-COOH) or carboxylic acid anhydride (RCO-O-COR).

Moreover, there is disclosed in JP 2002-334618, no good reason supporting the Examiner's opinion that "it would have been obvious to one of ordinary skill in the art to evaporate the solvent in the dispersion by a heat treatment at a temperature lower than 250°C without adding the compound (e.g. carboxylic acid (R-COOH) or carboxylic acid anhydride (RCO-O-CO)) to detach the coating to obtain dry fine metal particles covered with the coating of the compound having a group containing a nitrogen, oxygen or sulfur atom (e.g. alkyl amine R-NH₂).” In fact, JP 2002-334618 teaches only a fine metal particle dispersion used for production of a conductive film, and one having ordinary skill in the art would see no reason to evaporate the solvent.

Accordingly, JP 2002-334618 fails to teach or suggest any claimed fine metal particles in the form of dry powder.

Even if JP 2002-334618 discloses the same utility for any polar solvents as that for the preferable solvents, such as non-polar solvents or low-polar solvents, in the case of the process for preparation of the fine metal particle dispersion in which fine metal particles covered with the coating of the compound are dispersed in the solvent, there is no reasonable ground to consider that JP 2002-334618 suggests the same utility for any polar solvents as that for the preferable solvents, such as non-polar solvents or low-polar solvents, in the case of the process for preparation of dry fine metal particles covered with the coating of the compound.

In paragraph [0034] and [0035], JP 2002-334618 teaches the following criteria for selection of solvent contained in the fine metal particle dispersion:

[0034]

As for the organic solvent used for these two purposes, different organic solvents may be used, but it is preferred that the same organic solvent is used. The organic solvent

is not limited to a particular type as long as it is applicable for said two types of uses. It is preferable to select a nonpolar solvent or low polar solvent, rather than a high polar solvent in which the compound forming the coating layer on the surfaces of the fine metal particles, for example, such as an alkylamine, is so highly soluble that the coating layer on the surfaces of the fine metal particles may vanish away.

[0035]

In the process for formation of a conductive metal film that is substitutionally used for plating, according to the present invention, in addition, it is preferred that the organic solvent is capable of being relatively quickly evaporated and has thermal stability to such an extent that it does not undergo thermal decomposition even at a high temperature where a heat treatment for sintering is carried out after the step of coating. Further, in the case where a fine line is formed, as at the step of coating, the fine metal particle dispersion is applied by screen printing to form a coating film having a desired film thickness, the viscosity thereof must be kept within a desired liquid viscosity. Thus, in consideration of its ease of handling at such a step, a nonpolar solvent or low polar solvent with a relatively high boiling point which hardly evaporates around room temperature, for example, such as terpineol, a mineral spirit, xylene, toluene, ethylbenzene and mesitylene, is preferably employed, or hexane, heptane, octane, decane, dodecane, cyclohexane or cyclooctane may be also used therefor.

JP 2002-334618 clearly suggests that a nonpolar solvent or low polar solvent with a relatively high boiling point is fit to the criteria for selection of solvent, whereas a high polar solvent with a low boiling point is by no means fit to the criteria for selection of solvent.

Further, JP 2002-334618 clearly suggests that the solvent is also used as a reaction solvent for the reaction of the compound having reactivity with the compounds having the group containing the nitrogen, oxygen or sulfur atom in the step of heat treatment at the temperature being no higher than 250°C.

In view of these facts, JP 2002-334618 fails to suggest that alcohol solvents having a low boiling point of 80 °C or lower, ketone solvents having a low boiling point of 80 °C or lower and acetonitrile (b.p. 82 °C) would be suitably used as a solvent to be contained in fine metal particle dispersion of JP 2002-334618.

Accordingly, the Examiner's assertion "JP (,618A) discloses the same utility for any polar solvents having a boiling point of greater than the room temperature and lower than the sintering temperature" is without basis.

In conclusion, the distinctive features of the invention of the fine metal particles in the form of a dry powder as claimed in currently amended Claims 1 and 15 are by no means obvious over JP 2002-334618.

Thus, the fine mental particles in the form of a dry powder as claimed in currently amended Claims 1, 2, 29 and Claims 15, 35 are patentable over the cited reference.

CONCLUSION

In the light of the applicant's amendments to the claims and the foregoing Remarks, it is respectfully submitted that the present application is in condition for allowance. Should the Examiner have any remaining concerns which might prevent the prompt allowance of the application, the Examiner is respectfully invited to contact the undersigned at the telephone number appearing below.

No Disclaimers or Disavowals

Although the present communication may include alterations to the application or claims, or characterizations of claim scope or referenced art, Applicant is not conceding in this application that previously pending claims are not patentable over the cited references. Rather, any alterations or characterizations are being made to facilitate expeditious prosecution of this application. Applicant reserves the right to pursue at a later date any previously pending or other broader or narrower claims that capture any subject matter supported by the present disclosure, including subject matter found to be specifically disclaimed herein or by any prior prosecution. Accordingly, reviewers of this or any parent, child or related prosecution history shall not reasonably infer that Applicant has made any disclaimers or disavowals of any subject matter supported by the present application.

Co-Pending Applications of Assignee

Applicant wishes to draw the Examiner's attention to the following co-pending applications of the present application's assignee.

Docket No.	Serial No.	Title	Filed
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WAKAB81.002APC	10/556871	METHOD FOR FORMING FINE COPPER PARTICLE SINTERED PRODUCT TYPE OF ELECTRIC CONDUCTOR HAVING FINE SHAPE, AND PROCESS FOR FORMING COPPER FINE WIRING AND THIN COPPER FILM BY APPLYING SAID METHOD	15-Nov-2005
WAKAB81.004APC	11/571249	CONDUCTIVE METAL PASTE	18-Jan-2007
WAKAB81.005APC	11/994199	CONDUCTIVE CIRCUIT MANUFACTURING METHOD	28-Dec-2007

Please charge any additional fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410.

Respectfully submitted,

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